

WHAT IS CLAIMED IS:

1. A method of processing a substrate,
comprising:

5 forming a chemically amplified resist film on
a substrate;

irradiating energy beam to the chemically
amplified resist film to form a latent image therein;
moving a heating section relatively to the
chemically amplified resist film to heat with the
10 chemically amplified resist film forming the latent
image; and,

forming an gas stream between the heating section
and the chemically amplified resist film in the
movement of the heating section, the direction of the
15 air stream being reverse to the relatively moving
direction of the heating section.

2. The method according to claim 1, wherein the
range heated by the heating section has a slit shape.

3. The method according to claim 1, wherein the
20 heating section cools the chemically amplified resist
film except the range heated.

4. The method according to claim 3, wherein the
substrate is placed on a stage, and said cooling is
carried out to control the temperature of the stage.

25 5. The method according to claim 3, wherein said
cooling is carried out in a manner of forming the gas
stream on the chemically amplified resist film around

the heating range.

6. The method according to claim 1, wherein at least one of moving speed of the heating section to the substrate, heating temperature by the heating section, temperature of the gas stream, and gas stream speed is controlled to uniformly the heat treatment in the substrate surface.

7. The method according to claim 1, wherein at least one of moving speed of the heating section to the substrate, heating temperature by the heating section, temperature of the gas stream, gas stream speed and substrate temperature is controlled to uniformly the heat treatment in the substrate surface.

8. The method according to claim 1, wherein the energy beams is any of ultraviolet radiation, deep-ultraviolet radiation, vacuum ultraviolet radiation, electron beam and X rays.

9. A method of processing a substrate, comprising:
forming a chemically amplified resist film on a substrate;

irradiating energy beams to the chemically amplified resist film to form a latent image therein;
moving a heating section relatively to the chemically amplified resist film in order to carry out heating with respect to the chemically amplified resist film forming the latent image; and,

forming a liquid stream between the heating section and the chemically amplified resist film in the movement of the heating section.

10. The method according to claim 9, wherein the
5 range heated by the heating section has a slit shape.

11. The method according to claim 9, wherein the heating section cools the chemically amplified resist film except the range heated.

12. The method according to claim 11, wherein the
10 substrate is placed on a stage, and said cooling is carried out to control the temperature of the stage.

13. The method according to claim 11, wherein said cooling is carried out in a manner of forming the liquid stream on the chemically amplified resist film
15 around the heating range.

14. The method according to claim 9, wherein water is used as the liquid.

15. The method according to claim 9, wherein at least one of moving speed of the heating section to the
20 substrate, heating temperature by the heating section, temperature of the gas stream, and gas stream speed is controlled to uniformly the heat treatment in the substrate surface.

16. The method according to claim 9, wherein at
25 least one of moving speed of the heating section to the substrate, heating temperature by the heating section, temperature of the gas stream, gas stream speed and

substrate temperature is controlled to uniformly the heat treatment in the substrate surface

17. The method according to claim 9, wherein the energy beams is any of ultraviolet radiation, deep-ultraviolet radiation, vacuum ultraviolet radiation, electron beam and X rays.

18. The method according to claim 9, wherein developer is supplied onto the chemically amplified resist film in a state that the liquid exists thereon.

19. A method of processing a substrate, comprising:

forming a liquid film containing solvent and solid content;

moving a heating section relatively to the liquid film to carry out heat treatment for forming a solid film consisting of the solid content; and

forming an gas stream between the heating section and the liquid film in the movement of the heating section.

20. The method according to claim 19, wherein the range heated by the heating section has a slit shape.

21. The method according to claim 19, wherein the heating section cools the liquid film and the solid film except the range heated.

22. The method according to claim 21, wherein the substrate is placed on a stage, and said cooling is carried out to control the temperature of the stage.

23. The method according to claim 21, wherein said cooling is carried out in a manner of forming the gas stream on the chemically amplified resist film around the liquid film and the solid film.

5 24. The method according to claim 19, wherein at least one of moving speed of the heating section to the substrate, heating temperature by the heating section, temperature of the gas stream, and gas stream speed is controlled to uniformly the heat treatment in the
10 substrate surface.

 25. The method according to claim 19, wherein at least one of moving speed of the heating section to the substrate, heating temperature by the heating section, temperature of the gas stream, gas stream speed and
15 substrate temperature is controlled to uniformly the heat treatment in the substrate surface.

 26. A heating apparatus comprising:
 holding means configured to hold a substrate;
 a heating section arranged in a state of facing
20 the surface of the substrate held by the holding means, and selectively heating a partial range of the substrate;

 moving means configured to relatively moving the heating section and the substrate in parallel to the
25 main surface of the substrate;

 stream forming means configured to form gas or liquid stream between the heating section and the

substrate;

processing condition determining means configured to determine processing conditions of a heating range heated by the heating section; and

5 control means configured to uniformly heat the substrate surface based on determination by the processing condition determining means.

27. The apparatus according to claim 26, wherein the stream forming means comprises a supply section and
10 an gas sucker, which are arranged on both sides of the heating section in the relatively moving direction of the heating section and the substrate, the supply section supplies gas or liquid toward the gas sucker, and the gas sucker sucks gas or liquid supplied from
15 the supply section.

28. The apparatus according to claim 27, wherein the supply section and the gas sucker are located adjacent to the heating section.

29. The apparatus according to claim 26, further
20 comprising:

measurement means configured to measure the temperature of a heating range heated by the heating section,

the processing condition determining means
25 determining processing conditions of the heating range in accordance with the measured result by the measurement means.

30. The apparatus according to claim 26, further comprising:

5 detection means configured to irradiate monitor light to the heating range, and detecting an intensity of light reflected from the heating range,

the processing condition determining means determining processing conditions of the heating range based on the detection result by the detection means

10 31. The apparatus according to claim 26, wherein the heating section heats the substrate using thermal conduction from a heater or radiation from a light source.

15 32. The apparatus according to claim 31, wherein the light source is any of lamp, light emitting diode and laser.

33. The apparatus according to claim 32, wherein the heating section irradiates light emitted from the light source to the substrate.

20 34. The apparatus according to claim 32, further comprising:

optical fiber connecting the light source and the heating section, and guiding light from the light source to the heating section.

25 35. The apparatus according to claim 32, wherein the light from the light source contains a wavelength equivalent to infrared-ray range.

36. The apparatus according to claim 26, wherein

the holding means includes temperature control means for controlling the substrate temperature.

37. The apparatus according to claim 36, wherein the temperature control means controls the substrate temperature based on determination information of the processing condition determining means.

38. The apparatus according to claim 26, wherein the stream forming means controls at least one of the speed of gas or liquid stream and the temperature of gas or liquid stream based on determination of the processing condition determining means.

39. The apparatus according to claim 26, further comprising:

a developer supply section arranged on the backward side in the relatively moving direction of the heating section, and movable relatively to the substrate while supplying developer thereto.

40. A method of forming a pattern, comprising:

forming a photo resist film on a substrate;
forming liquid film on the photo resist film surface;

irradiating energy beams to the photo resist film via the liquid film to form a latent image in the photo resist film; and

developing the photo resist film formed with the latent image,

wherein the surface of the photo resist film being

not dried until developing is carried out after the liquid film is formed.

41. The method according to claim 40, further comprising:

5 heating the photo resist film at the temperature holding the liquid film on the substrate between the forming the latent image and the forming liquid film.

 an electric field being applied to the photo resist film in the heating.

10 42. The method according to claim 41, wherein the photo resist film is heated by heating the backside of the substrate, and the electric field application is voltage application to an electrode located on an upper portion of the photo resist film.

15 43. The method according to claim 41, wherein the electric field applied to the photo resist film is alternating current.

 44. The method according to claim 40, wherein the wavelength of the energy beams is generally longer than
20 193 nm.

 45. The method according to claim 40, wherein the wavelength of the energy beams is generally 157 nm, and the liquid film consists of fluorine oil.

25 46. The method according to claim 40, wherein the development is carried out in a manner of supplying developer to the photo resist film while relatively moving a developer supply section, which sucks the

supplied developer, to the photo resist film.

47. A method of forming a pattern, comprising:
forming a chemically amplified resist film on
a substrate;

5 forming liquid film on the chemically amplified
resist film surface;

irradiating energy beams to the chemically
amplified resist film via the liquid film to form
a latent image therein;

10 heating the chemically amplified resist film
formed with the latent image, and

developing the chemically amplified resist film
heated,

the surface of the photo resist film being not
15 dried until developing is carried out after the liquid
film is formed.

48. The method according to claim 47, wherein the
wavelength of the energy beams is generally longer than
193 nm.

20 49. The method according to claim 47, wherein the
wavelength of the energy beams is generally 157 nm, and
the liquid film consists of fluorine oil.

50. The method according to claim 47, wherein the
heating section heating part of the resist films is
25 moved relatively to the substrate in the heating; and
forming a liquid stream between under surface of
the heating section and upper surface of the chemically

amplified resist film in the moving.

51. The method according to claim 47, wherein
the developing is carried out in a manner that the
developer supply section moving relatively to the
5 substrate supplies developer to the chemically
amplified resist film, and sucks the supplied
developer.

52. The method according to claim 47, wherein
the pre-bake process is carried out using light
10 irradiation.